Digital Radio: the Sound of the Future: the Canadian Vision

DIGITAL RADIO

THE SOUND OF THE FUTURE

The Canadian Vision

TASK FORCE ON THE INTRODUCTION OF DIGITAL RADIO

DIGITAL RADIO

THE SOUND OF THE FUTURE

The Canadian Vision

TASK FORCE ON THE INTRODUCTION
OF DIGITAL RADIO

Third Printing March 1995
Second Printing March 1994

Publié également en français

Cat. No. Co22-132/1993E-rev.1995
ISBN 0-662-23100-7

Contents

Preface 5

What is digital radio . . .
and what does it offer Canadians? 6

The nitty-gritty: Some questions and
answers about Canadian digital radio 16

Agenda for action:
The Canadian digital radio timetable 23

Summary: The Sound of the Future 27

List of Task Force Members 28

This third printing includes minor updates, most particularly to the timeline on pages 25 and 26. References to the former Department of Communications have been changed to Department of Canadian Heritage or Industry Canada, as appropriate.

Participants in the Task Force on the Introduction of Digital Radio

CEMC
CONSUMER ELECTRONICS MARKETERS OF CANADA
ASSOCIATION CANADIENNE DE MARKETING D'ÉLECTRONIQUE DOMESTIQUE

CBC SRC

Government of Canada / Gouvernement du Canada

Canadian Radio-television and Telecommunications Commission / Conseil de la radiodiffusion et des télécommunications canadiennes

The National Campus and Community Radio Association
L'Association nationale des radios étudiantes et communautaires

ASSOCIATION DES RADIODIFFUSEURS COMMUNAUTAIRES DU QUÉBEC

ARC Canada
Alliance des radios communautaires

The Canadian Association of Broadcasters
L'Association canadienne des radiodiffuseurs

Preface

Digital radio **is** the sound of the future.

It will be the best sound on the airwaves before the end of this century, because digital radio has the potential to deliver CD-quality, interference-free sound.

But what exactly is digital radio? And why will it sound better — and provide more consistent, reliable reception — than any existing form of radio?

This booklet has been prepared to answer these questions. It is a straightforward, no-nonsense guide that explains what digital radio is, how it works, how Canada will introduce it, and, most importantly, why we need it.

The Task Force on the Introduction of Digital Radio compiled this guide. Established by the Minister of Communications in 1992, the Task Force is a government-industry alliance charged with guiding Canadian digital radio from concept to reality, for the benefit of all.

What is digital radio . . . and what does it offer Canadians?

Digital radio: what exactly IS it?

Digital radio is the transmission and reception of sound which has been processed using technology comparable to that used in CD players.

In short, a digital radio transmitter processes sounds into patterns of numbers, or 'digits': hence the name, 'digital radio'.

At the listening end, digital radio receivers provide a standard of sound quality that is significantly better than conventional analog radios, just as CDs sound better than LPs.

Why does digital radio sound better than conventional radio?

Digital radio provides crystal clear sound comparable in quality to CDs, or to the acoustics of a fine concert hall.

Conventional analog radio cannot meet this standard, simply because of the technology used and the transmission environment in which it is broadcast.

In other words, although an analog radio can sound quite good, it can never sound as good as a digital radio, just as an LP cannot deliver the dynamic range of a CD.

As well — unlike AM and FM — digital radio reception is virtually immune to interference, which means there are no static growls or 'multipath' echoes (caused by signal reflections off buildings or

Digital Radio

topographic features) to make listening unpleasant, whether at home, or in the car. In short, digital radio eliminates the noise that creeps into analog radio transmission and reception.

The reason digital radio is so reliable is because it employs a 'smart' receiver. Inside each digital radio receiver there is a tiny computer: a computer capable of sorting through the myriad of reflected and atmospherically distorted transmissions and reconstructing a solid, usable signal for the set to process.

In contrast, an un-intelligent analog receiver cannot differentiate the useful information from the useless noise. It reproduces the entirety of whatever signal it is tuned to: static, 'multipath' echoes, and all.

Analog Radio

Digital radio: Potential benefits for listeners

Because the digital radio receiver is a 'smart' set, it can do much more than just pick up radio signals. Here are a few examples:

- **easy tuning:** simply select the station you want from the call letters or names displayed sequentially on your digital radio LCD (liquid crystal display) and the computer within the radio will do the rest. (There will be no need to punch in frequencies; your radio will provide you with a list of station call signs, broadcast by the stations themselves, and you'll select which one you want.)

In addition, your digital radio will be capable of monitoring signal strengths and of using this information to switch automatically from a fading signal (in the car, the transmitter you are driving away from) to a new, more powerful one (the transmitter you are approaching).

This capability will make two new tuning options possible.

First, imagine you are driving from Halifax to Vancouver, and you want to hear CBC Radio enroute. All you will have to do is select 'CBC' from your LCD display, and continue driving. Your digital radio will take over the tuning from there by switching from one transmitter to another without any noticeable signal disruption as far as you, the listener, are concerned.

Secondly, it may also be possible to program your digital radio to select a particular music format, such as 'Top 40'. Thus, as you travel away from the Top 40 station you have been listening to, your digital radio will scan the station information being sent to it by local digital radio stations to find another Top 40 broadcaster, and then tune it in for you — automatically!

- **information:** because your set will have an LCD display, a lot more can be sent to it besides station call signs. Other possibilities include:
  - song titles, artist, and album names and lyrics;
  - traffic and weather information, including emergency warnings;
  - paging services;

• text services, such as stock market quotations;

• complementary information about a product being advertised on-air; for instance, if a car dealer is offering a special financing package, the LCD could display specific information about the rates and terms being offered.

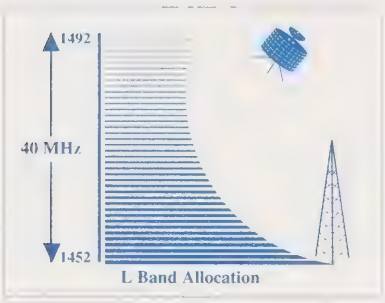
■ **addressable radio:**
because your digital radio is smart, it will be possible to program it to receive services such as 'pay radio' (for example, live concerts that you pay to receive).

Beyond this, there are other, more futuristic possibilities for digital radio that may develop, for instance, personal receivers that could correlate and compare the signals from 'Global Positioning Systems' satellites in order to pinpoint your exact geographical location. As well, due to the digital processing at the heart of this innovative technology, it is also possible that digital radio could one day be used to transmit and receive computer file downloads and fax transmissions.

Digital radio:
Potential benefits for broadcasters

The primary benefit for all Canadian broadcasters, of course, will be capability of finally providing listeners with the very best quality sound on radio: sound that will be capable of competing with high-fidelity audio sources such as CDs, digital cassettes and digital audio services. (Unless broadcasters find a way to meet this competition, they are in danger of losing listeners, particularly teens, to these high-quality sources.)

All listeners and broadcasters will benefit because the goal of both industry and government is to see Canadian services eventually move from the existing AM and FM bands to a new, single digital radio band in the 1452–1492 megahertz (MHz) range, which will allow the reception of both terrestrially and satellite-originated signals. (As a comparison, the present services operate on two separate bands: FM is 88–108 Mhz; AM is 0.525–1.705 Mhz. Neither of these bands is suitable for satellite signals.)



This range, which lies in a portion of the broadcasting spectrum known as the 'L-Band', was selected after exhaustive Canadian research.

In 1992 Canada proposed using the L-Band for digital radio. Since then, most of the world has agreed. In fact, in February 1992, the World Administrative Radio Conference (WARC), which negotiates frequency allocations globally, endorsed Canada's position and officially designated the L-Band as the future worldwide home for digital radio.

By moving all AM and FM services to L-Band, all broadcasters will be assured an equal 'first chance' in competing for audiences — something that simply is not the case today, due to the transmission properties that limit the audio quality of the current radio bands, especially AM.

Another advantage of digital radio transmission: areas that suffer 'signal gaps' due to blockage by hills or buildings can literally be 'gap-filled' by installing very-low power digital radio repeaters in these locations. This is possible due to the digital radio receiver's 'intelligence'. Unlike conventional receivers, digital radio receivers are capable of sorting through a number of signal paths on the same frequency, a capability that will aid in the conservation of scarce radio spectrum.

In other words, every broadcaster can enter the digital radio marketplace on an equal footing; where they go from there will depend on individual creativity and market savvy.

There is also the potential for broadcasters to generate new revenues, through data transmission on digital radio, by using the radios' LCD displays to provide value-added advertising services (including paging), and by getting a share of direct marketing dollars through electronic couponing (where actual product discounts will be transmitted to the receiver and recorded on a removable card, which can then be taken by the consumer to a store for electronic redemption.)

In short, digital radio has the technical potential to revitalize radio as a cost-effective and powerful advertising medium.

Finally, broadcasters should be able to make this transition in a cost-effective manner because the digital radio transmitters currently being tested can carry up to six stereo services at once, meaning that the cost of transmission can be shared among as many as six stations. And, because the power requirements are considerably lower for generating digital radio transmissions, the operating costs should be substantially reduced as well.

The result?
Everybody wins from digital radio

For the listener, digital radio will be more than just 'the best sound on the airwaves', it will be an intelligent communications device that will offer more services and conveniences than can be provided by conventional analog technology.

For the broadcaster, digital radio is not just a way to stay competitive with other forms of digital sound, but one that offers numerous new business opportunities as well.

THE NITTY-GRITTY:
Some questions and answers about Canadian digital radio

Please note:
If you don't want to read about details, please go to the next section; you don't need to know them to understand the importance of digital radio. However, if you are interested in details, read on!

Why isn't digital radio on-air NOW?

At the start of this booklet, we briefly explained how digital radio uses digital technology to deliver CD-quality, interference-free sound.

This, however, begs a question: if digital radio is so great, why isn't it on-air now?

The answer — the limits of AM and FM bandwidth.

In broadcasting terms, bandwidth is the radio spectrum 'space' required to deliver a given signal.

Different types of signals require different bandwidths, for instance, current TV signals require 6 MHz of bandwidth per channel, FM requires 0.25 MHz, while AM radio only needs 0.01 MHz per channel.

Unfortunately, what has stood in the way of digital radio is the amount of bandwidth required to transmit it; up to 1.5 MHz per stereo service, thanks to the fact that each service requires 1.5 million bits per second of data to reproduce stereo sound.

So what has changed?

What's changed the situation is the advent of a new technology known as 'digital compression', a technology that makes it possible to compress digital signals to allow transmission within a much smaller bandwidth.

In the case of digital radio, digital compression makes it possible to reduce the number of bits in a stereo signal from 1.5 million down to less than a quarter of a million per second, without any noticeable difference in perceived sound quality.

Obviously, this reduction in digital radio signal bits reduces the amount of bandwidth required by digital radio as a whole.

However, there is more to choosing a frequency for digital radio broadcasting than bandwidth alone.

The goal: To find a suitable bandwidth for digital radio

For Canadian researchers, the objective has been to select a frequency band that has the capacity to efficiently transmit both terrestrial- and satellite-based digital radio signals, so that remote areas of Canada can receive coverage comparable to densely populated urban areas.

The AM and FM bands are not practical for digital radio

We believe that moving digital radio into the AM and FM bands simply is not practical. Not only are these bands already crowded, but, as we have seen, they both suffer from various interference problems. As well, these bands are impractical for satellite transmissions — the receiving antennas would have to be enormous.

That is why the alliance of Canadian government-industry researchers has focused its attention on the 'L-Band'.

Canadian research has proven that L-Band digital radio transmissions have none of the problems associated with AM and FM. In fact, L-band digital radio can be designed to provide interference-free reception even in moving cars and on personal portable radios (whether from terrestrial- or satellite-based transmitters) with none of the distortion or fading common to AM and FM.

What do other countries think of our position?

As mentioned earlier, the 1992 World Administrative Radio Conference accepted the thoroughness and logic of Canada's digital radio research and made the L-Band the only radio spectrum allocated for digital radio transmissions on a worldwide basis. (The actual use of the L-Band by individual countries for digital radio will depend on its current domestic availability and whether adjacent countries are also planning to use it for digital radio broadcasting.)

Why is the United States not moving on L-Band digital radio?

At present, the U.S. domestic L-Band is not available for use by digital radio.

As well, many American broadcasters have no desire to see this allocation altered, because they perceive L-Band digital radio as a potential threat to existing radio stations.

In the view of these people, the establishment of L-Band digital radio stations would result in the creation of a third radio band (in addition to AM and FM), a new band whose better-sounding stations would attract revenue away from conventional AM and FM broadcasters, which are already having problems generating sufficient profits in the crowded U.S. radio market.

(This possibility, by the way, is completely avoided by the Canadian government-industry plan to move all Canadian AM and FM stations to the L-Band.)

In an effort to head off this perceived threat from L-Band broadcasting, some American entrepreneurs and broadcasters are trying to develop a form of digital radio that will work within the existing bandwidths allocated to the AM and FM stations. In other words, they are trying to design a version of digital radio that can be adopted by existing broadcasters without resorting to L-Band.

Known as the 'in-band on-channel' (IBOC) solution, it remains to be proven whether a satisfactory solution can be found for both AM and FM. Although it would be irresponsible to assume that a solution cannot be found, many radio people worldwide are skeptical that this American initiative can deliver significant improvements.

For one thing, most countries want future digital services to be delivered by both satellite- and terrestrial-based transmitters. Due to the transmission properties of AM and FM (outlined earlier), the IBOC system is not practical for satellite use.

The problem is that even if the IBOC system could be made to perform in the lab, it may not perform in the field. As well, IBOC digital radio may not be able to overcome the fading and multipath problems associated with FM transmission. In short, it is unlikely to outperform in any markedly superior manner conventional analog FM signals, particularly in cars.

As for AM? Even the reduced bandwidth requirements of compressed digital radio signals may be more than this frequency range can reasonably provide, particularly if it is necessary to transmit both conventional AM and IBOC digital services in the same band. Moreover, local AM broadcasters are subject to severe interference from distant stations during the nighttime hours, which would seriously degrade digital radio performance on this band.

This means that any workable IBOC solution might only be usable in the FM band, which would effectively leave AM stations out in the cold.

Thus, current disparities between AM and FM stations — which have devastated AM operators in the unregulated American marketplace — would only be heightened by such an approach.

By contrast, the Canadian approach benefits **both** AM and FM. As well, Canadian Radio-television and Telecommunications Commission (CRTC) content regulations and market-entry licensing requirements have ensured some protection for domestic AM broadcasters.

In short, the problem with in-band digital radio is that it does not have the potential to offer significant performance improvements either to broadcasters or listeners. And, obviously, if the public does not perceive digital radio as providing any real improvements, they will not buy the receivers. That is why Canada, backed by solid and substantial research, has elected to go to the wider bandwidth in the L-Band to achieve maximum benefits.

The big question: What will it cost?

At present, the technology of digital radio is still under development, so it is impossible for manufacturers to realistically set prices at this time. However, current research suggests the following:

For consumers, it is anticipated that digital radio receivers will eventually cost roughly as much as a good FM radio does today, as soon as there is enough sales volume to bring down manufacturing costs.

For broadcasters, digital radio could actually result in reduced equipment costs. That is because, although digital radio transmitters are expected to be comparable in price to FM transmitters, the cost of operating a single digital unit could be shared among the six stations that use it.

AGENDA FOR ACTION:
The Canadian digital radio timetable

So far, we have seen the possibilities of digital radio. We have learned how it works, and how it is the best alternative for both listeners and broadcasters alike.

That said, what is being done to make it a reality?

Canadian private and public broadcasters, in alliance with the federal government, have been working for a number of years to devise a sensible, economical, and low-impact (on both consumers and broadcasters) approach to introducing digital radio to Canada.

This co-operation first gained attention in June 1990, when a government-industry group staged a demonstration of the European-designed Eureka-147 digital radio system in four Canadian cities.

Since that time, these partners have worked together in researching the transmission requirements of digital radio, research which led to the acceptance of the L-Band by WARC in 1992.

Their work also generated enough momentum to convince the Minister of Communications to establish the Task Force on the Introduction of Digital Radio in June 1992. Its role — to guide the introduction of digital radio in Canada and to make recommendations to the government as needed. In addition

to the original players - the Canadian Association of Broadcasters, the Canadian Broadcasting Corporation, and the Department of Communications–the Task Force also included senior representatives from community radio, and campus and community radio, the Consumer Electronics Marketers of Canada, the Canadian music industry, and the CRTC.

The Task Force has a specific set of principles as objectives. Broadly, these are:

- digital radio should provide a level of sound quality and reception reliability that is strikingly superior to AM and FM;
- digital radio should be introduced in an non-disruptive manner, in other words, there should be sufficient transition period to allow both consumers and broadcasters to switch over to digital radio as easily as possible;
- spectrum should be allocated in a way that is efficient, while providing for optimum performance;
- digital radio should be implemented outside AM and FM, in the L-Band, to ensure the freedom to achieve an optimal digital radio system and to ensure that both satellite- and terrestrial-based broadcasts are feasible within the same single bandwidth;
- digital radio should be a replacement for existing AM and FM stations.

Timeline: When will all this happen?

What follows is a chronology of the development of digital radio in Canada, and our 'best informed guess' of where it is heading, a growth that will bear fruit before the year 2000.

1993

Public and private broadcasters form Digital Radio Research Inc. (DRRI), to own and operate experimental transmitters.

Eureka-147 opens consortium to additional members.

1994

Task Force makes recommendations on the necessary regulatory and policy framework for digital radio, and recommendations on coverage and service area issues.

Canada hosts Second International Symposium on Digital Radio in Toronto.

DRRI opens permanent, experimental digital radio stations in Toronto and Montreal.

Working Parties of the International Telecommunications Union's Radiocommunication Study Groups recommend Eureka-147 for both terrestrial and satellite broadcasting.

1995

- Industry Canada makes public its proposed frequency allotments for domestic radio.

- First commercial terrestrial broadcasts of digital radio begin, starting the transition period from analog to digital radio.

- First commercial digital radio receivers come on the market for consumers.

2003 – 2005

- Direct satellite services begin.

2010 and beyond

- Eventually all AM and FM transmitters in Canada are shut down after the move to the L-Band is complete and the public has accepted digital radio.

SUMMARY:
The Sound of the Future

Now that you have read through this booklet, you can see how digital radio truly **is** the 'sound of the future', and how Canadian leadership — both in research and unparalleled government-industry alliances — has brought digital radio much closer to reality in the past few years.

The future will be just as exciting, in fact, probably more so. That is because we, as Canadians, are at the front line of change, a fundamental change that will be as profound for radio as the evolution from hand-cranked 78s to CD players was for home audio systems.

It is a bright future for listeners and broadcasters alike: a future that truly promises to provide 'the best sound on the airwaves' not just for all Canadians, but for the world as well.

Task Force on the Introduction of Digital Radio

Members	*Representing*
Peter Kruyt (Chair) President	Power Broadcasting Inc.
Michael McEwen (Vice-chair) Senior Vice-President - Media	Canadian Broadcasting Corporation
Michael Binder Assistant Deputy Minister Spectrum, Information Technologies and Telecommunications	Industry Canada
Lucie Gagnon Secrétaire générale adjointe Association des radiodiffuseurs communautaires du Québec	Campus and Community Radio
Ken Kewin	Consumer Electronics Marketers of Canada
Victor Rabinovitch Assistant Deputy Minister Cultural Development and Heritage	Department of Canadian Heritage
Duff Roman Vice-President Industry Relations CHUM Limited	Canadian Association of Broadcasters

Members (cont.)	*Representing*
William Sawchuk Director General Broadcast Technologies Research Branch Communications Research Centre	Joint Technical Committee on Advanced Broadcasting

Observers	*Representing*
David Basskin President, Canadian Music Reproduction Rights Agency	Task Force on the Future of the Canadian Music Industry
David Colville Commissioner	Canadian Radio-television and Telecommunications Commission